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TELEPHONE (864) 271-1592
TELECOPIER (864) 233-7342

MAIL TO : PO BOX 1449
GREENVILLE, SC 29602-1449

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FROM: Jason W. Johnston

MESSAGE: Pursuant to your request, enclosed is the supplemental brief for the above-referenced application.

TRANSMITTED BY: Lynn Watkins

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PATENT
ATTORNEY DOCKET NO: AGX-37

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	Shooshtarian, et al.	)	Examiner:	Hsein Ming Lee
Appl. No:	09/527,873	)	Art Unit/T.C:	2823
Filed:	March 17, 2000	)	Deposit Acct. No:	04-1403
Title:	Localized Heating and Cooling of Substrates	)	Confirmation No:	4182
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Board of Patent Appeals and Interferences
United States Patent and Trademark Office
PO Box 1450
Arlington, Virginia 22313-1450

SUPPLEMENTAL BRIEF ON APPEAL

Dear Sir:

In response to the communication dated December 20, 2004 for the above-captioned patent application and in conjunction with the Brief of Appeal previously submitted on June 10, 2005, Appellant submits the following Supplemental Brief on Appeal in accordance with 37 C.F.R. § 41.37.[1]

1. **Real Party in Interest**

The real party in interest with respect to the above-captioned application and with respect to this appeal is Mattson Technology, Inc.

[1] As discussed in a telephonic interview with Examiner Lee on August 9, 2005, the Supplemental Brief is being submitted simply to add the "Evidence Appendix" and "Related Proceedings Appendix" pursuant to 37 C.F.R. § 41.37.

2. Related Appeals and Interferences

Appellant is not aware of any other prior or pending appeals, interferences or judicial proceedings that may be related to, directly affect or be directly affected by or having a bearing on the Board's decision in this appeal.

3. Status of Claims

Claims 1-2, 4-13, 42, and 44-63, all of which are attached hereto in the Claims Appendix, are currently pending in the present application, including independent claims 1, 46, and 48-50. Previously, claims 3, 14-41, and 43 were cancelled. Claims 1-2, 4-13, 42, and 44-63 (all the pending claims) are being appealed.

In a Final Office Action mailed on December 20, 2004, claims 1-2, 5, 8-13, 44-45, 48, 50-51, 53, 56-60, and 62-63, which include independent claims 1, 48, and 50, were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,814,365 to Mahawili. In addition, claims 4, 6-7, 42, 46-47, 49, 52, 54-55, and 61, which include independent claims 46 and 49, were rejected under 35 U.S.C. § 103(a) as being unpatentable over Mahawili in view of U.S. Patent No. 5,874,711 to Champetier, et al.

4. Status of Amendments

All amendments in this case have been entered.

5. Summary of Claimed Subject Matter

Independent claim 1 is directed to a method for heat treating a semiconductor wafer. (Appl., p. 3, lines 21-23). The wafer is placed in a thermal processing chamber that is in communication with a plurality of lamps, and the wafer defines a plurality of localized regions along a radial axis. (Appl., p. 4, lines 11-14; p. 7, lines 23-25; p. 8, lines 5-8). The temperature of the semiconductor wafer is adjusted to a predetermined

temperature according to a predetermined heat cycle, and this heat cycle includes a heating stage during which the semiconductor wafer is heated by the plurality of lamps. (Appl., p. 4, lines 19-20). During at least one stage of the heat cycle, a gas is provided to selectively control the temperature of at least one of the localized regions of the semiconductor wafer to minimize temperature deviation of the at least one localized region from the predetermined temperature. (Appl., p. 7, line 28 – p. 8, line 4; p. 8, line 28 – p. 9, line 12; p. 25, lines 26-28).

Additionally, independent claim 46 is directed to a method for heat treating a semiconductor wafer. (Appl., p. 3, lines 21-23). The semiconductor wafer is placed in a thermal processing chamber, and the semiconductor wafer defines a plurality of localized regions along a radial axis. (Appl., p. 4, lines 8-9; p. 8, lines 5-8). The temperature of the semiconductor wafer is adjusted using a plurality of lamps to a predetermined temperature according to a predetermined heat cycle, and the predetermined heat cycle includes a heat stage. (Appl., p. 4, lines 19-20). During at least one stage of the predetermined heat cycle, a gas is provided to selectively control the temperature of at least one of the localized regions of the semiconductor wafer to minimize temperature deviation of the at least one localized region from the predetermined temperature, the gas being supplied by a reflective device located below the semiconductor wafer. (Appl., p. 7, line 28 – p. 8, line 4; p. 8, line 28 – p. 9, line 12; p. 25, lines 26-28; p. 12, lines 24-25; p. 15, lines 4-15).

Moreover, independent claim 48 is directed to a method for heat treating a semiconductor wafer. (Appl., p. 3, lines 21-23). In this method, a semiconductor wafer is placed in a thermal processing chamber, the semiconductor wafer defining a plurality

of localized regions along a radial axis. (Appl., p. 4, lines 8-9; p. 8, lines 5-8). The temperature of the semiconductor wafer is adjusted using a plurality of lamps to a predetermined temperature according to a predetermined heat cycle, the predetermined heat cycle including a heat stage. (Appl., p. 4, lines 19-20). During at least one stage of the predetermined heat cycle, a gas is provided to selectively control the temperature of at least one of the localized regions of the semiconductor wafer to minimize temperature deviation of the at least one localized region from the predetermined temperature, the gas being supplied by a gas pipe located above the semiconductor wafer, wherein the gas pipe has a plurality of gas outlets. (Appl., p. 7, line 28 – p. 8, line 4; p. 8, line 28 – p. 9, line 12; p. 25, lines 26-28; p. 5, lines 19-26).

Furthermore, independent claim 49 is directed to a method for heat treating a semiconductor wafer. (Appl., p. 3, lines 21-23). A semiconductor wafer is placed in a thermal processing chamber that is in communication with a plurality of lamps, the semiconductor wafer defining a plurality of localized regions along a radial axis. (Appl., p. 4, lines 11-14; p. 7, lines 23-25; p. 8, lines 5-8). The temperature of the semiconductor wafer is adjusted to a predetermined temperature according to a predetermined heat cycle, the predetermined heat cycle including a heating stage in which the semiconductor wafer is heated by the plurality of lamps. (Appl., p. 4, lines 19-20). During at least one stage of the predetermined heat cycle, a gas is provided to selectively control the temperature of at least one of the localized regions of the semiconductor wafer to minimize temperature deviation of the at least one localized region from the predetermined temperature. (Appl., p. 7, line 28 – p. 8, line 4; p. 8, line 28 – p. 9, line 12; p. 25, lines 26-28). The gas used to selectively control the

temperature of at least one of the localized regions is supplied by a device located below the semiconductor wafer, wherein the device is a reflective device through which a plurality of gas outlets extend. (Appl., p. 12, lines 24-25; p. 15, lines 4-15).

In addition, independent claim 50 is directed to a method for heat treating a semiconductor wafer. (Appl., p. 3, lines 21-23). In this method, a semiconductor wafer is placed in a thermal processing chamber that is in communication with a plurality of lamps, the semiconductor wafer defining a plurality of localized regions along a radial axis. (Appl., p. 4, lines 11-14; p. 7, lines 23-25; p. 8, lines 5-8). The temperature of the semiconductor wafer is adjusted to a predetermined temperature according to a predetermined heat cycle, the predetermined heat cycle including a heating stage in which the semiconductor wafer is heated by the plurality of lamps and a cooling stage. (Appl., p. 4, lines 19-20; p. 8, line 21 – p. 9, line 4). During the cooling stage, a gas is provided to selectively control the temperature of at least one of the localized regions of the semiconductor wafer to minimize temperature deviation of the at least one localized region from the predetermined temperature. (Appl., p. 7, line 28 – p. 8, line 4; p. 8, line 28 – p. 9, line 12; p. 25, lines 26-28).

6. <u>Grounds of Rejection to be Reviewed on Appeal</u>

Independent claims 1, 48, and 50 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,814,365 to <u>Mahawili</u>. Independent claims 46 and 49 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over <u>Mahawili</u> in view of U.S. Patent No. 5,874,711 to <u>Champetier, et al.</u>

7. Argument

I. Claims 1, 48, and 50 Are Patentable Under 35 U.S.C. § 102(b) Over U.S. Patent No. 5,814,365 to Mahawili.

A claim is anticipated only if each and every element as set forth in the claim is found in a single prior art reference. See Verdegaal Bros. v. Union Oil Co. of Calif., 814 F.2d 628 (Fed. Cir. 1987). Although anticipation under Section 102 is not an *ipsissimis verbis* test (e.g., identity of terminology is not required), the elements must be arranged as required by the claim, and the identical invention must be shown in as complete detail as is contained in the claim. In re Bond, 910 F.2d 831 (Fed. Cir. 1990); Richardson v. Suzuki Motor Co., 868 F.2d 1226 (Fed. Cir. 1989).

In the present case, Appellant respectfully submits that the methods recited in independent claims 1, 48, and 50 patentably define over Mahawili because Mahawili does not teach each and every element set forth in these claims. Each of claims 1, 48, and 50 (as well as independent claims 46 and 49 discussed in Section 7.II. below) requires the step of *providing a gas to selectively control the temperature* of at least one of the localized regions of a semiconductor wafer *to minimize temperature deviation of the at least one localized region from a predetermined temperature*. This step is simply not present in Mahawili.

A. In Mahawili, "Temperature Control" of a Semiconductor Substrate Occurs, But *Not* By "Providing a Gas" According to Appellant's Claims.

Generally, Mahawili is directed to a reactor and a method for processing a semiconductor substrate. The reactor of Mahawili contains, *as separate parts*, (1) a heater assembly 14, (2) an emissivity measurement assembly 60, and (3) a gas injection assembly 34. The heater assembly of Mahawili delivers radiant heat to the

substrate in a manner such that the substrate temperature is substantially uniform, and the heater assembly may include an array of heating elements such as linear tungsten-halogen lamps. (Col. 5, lines 4-22). The emissivity measurement assembly measures the photon density from a light source and the reflected photon density off the substrate, and these emissivity measurements are used to determine the temperature of the substrate. (Col. 2, lines 54-62). The gas injection assembly in Mahawili's reactor is adapted to inject and direct at least one gas onto a discrete area of the semiconductor substrate, and this gas injection assembly may include a plurality of gas injectors. (Col. 3, lines 4-10 and 37-58).

Throughout Mahawili, *temperature control* of the semiconductor substrate occurs in several precise ways. Specifically, Mahawili's heater assembly (e.g., heater assembly 14 in Figures 2-3 and 6), which is enclosed in heater housing 16, includes an array of heating elements such as linear tungsten-halogen lamps. (Col. 4, line 60 – col. 5, line 22). Heater assembly 14 delivers heat to semiconductor substrate 12 in a uniform manner, for example, by forming a plurality of heating zones which provides a concentrated heating profile with a greater amount of heat being applied to the outer perimeter of the substrate than the center of the substrate. (Col. 5, lines 4-22).

Additionally, with regard to *temperature control*, Mahawili's non-contact emissivity measurement assembly 60 measures the emissivity and calculates the temperature of substrate 12 during fabrication processes. Specifically, a photon density sensor 70 measures the incident photon density from a light source 72 and measures the reflected photon density off the device side 12a of the semiconductor substrate 12, and eventually the temperature of the substrate 12 is calculated. (Col. 8, line 44 – col. 9,

line 60). Temperature readings taken by the emissivity measurement assembly 60 may be used to deliver proportional power ***to each of the lamp zones within heater assembly 14*** and, more generally, to monitor and control the output of heater assembly 14 or to adjust the profile of the applied heat. (Col. 9, lines 26-55; col. 10, lines 28-34).

Neither heater assembly 14 nor emissivity measurement assembly 60—the two assemblies involved in *controlling the temperature* of the semiconductor substrate in Mahawili—***provides a gas*** *to selectively control the temperature* of at least one localized region of a semiconductor wafer *to minimize temperature deviation of the at least one localized region from a predetermined temperature*. Rather, any *temperature control* occurring in Mahawili relies on increasing or decreasing the output of the heater assembly 14, e.g., increasing or decreasing the output of the heating elements such as the linear tungsten-halogen lamps.

At page 6, the Final Office Action referred to column 4, line 62 – column 5, line 3 of Mahawili, which states:

> [R]eactor 10 includes a heater assembly 14, which delivers heat to the substrate 12 in a uniform manner, a gas injection assembly, 34, which selectively delivers and directs gas to a discrete region of the substrate in a uniform and controlled manner, **and an emissivity measurement assembly 60, which permits continuous emissivity measurement of the average surface area of the device side of the substrate during processing so that the amount and/or the profile of the heat being delivered to the substrate during processing may be adjusted.**

While the Final Office Action cited this text from Mahawili in an attempt to prove that the reference contains the "providing a gas . . ." step of Appellant's claims, the passage actually supports the fact that Mahawili *does not* teach Appellant's claimed "providing a gas . . ." step.

In the emphasized portion of the passage above, the only things that are "adjusted" according to emissivity measurements (which eventually turn into temperature measurements) are (1) the "amount . . . of the heat being delivered to the substrate during processing" and (2) the "profile of the heat being delivered to the substrate during processing."

Adjusting the "amount" of heat being delivered to the substrate during processing, again, means adjusting the output of the heating elements contained in Mahawili's heater assembly 14. Adjusting the "profile" of the heat being delivered to the substrate during processing simply means "adjusting the profile of the applied heat," for example, by layering the linear tungsten-halogen lamps to form a plurality of heating zones which provide a concentrated heating profile with a greater amount of heat being applied to the outer perimeter of the substrate than the center. (Col. 2, lines 43-46; col. 5, lines 4-22). All of these "adjustments" for "temperature control" in Mahawili have nothing to do with "providing a gas."

With regard to *temperature control*, Mahawili summarizes at the end of the patent that its reactor and method provide:

> a reactor chamber which heats a substrate in a uniform manner and accurately measures the emissivity and calculates the temperature of the substrate during processing using a non-contact photon density measuring device and *adjusts the profile of the applied heat as needed* to achieve optimal processing of the substrate.

(Col. 10, lines 28-34) (emphasis added). Simply put, Mahawili does not disclose "providing a gas" *to selectively control the temperature* of at least one of the localized regions of a semiconductor wafer *to minimize temperature deviation of the at least one localized region from a predetermined temperature.*

B. In Mahawili, "Providing a Gas" Occurs, But *Not* "To Selectively Control the Temperature" of a Localized Region of a Semiconductor Wafer According to Appellant's Claims.

As mentioned above, Mahawili's reactor *is* equipped with a gas injection assembly 34, which, during processing, directs one or more reactant gases to the semiconductor substrate in a uniform and controlled manner (e.g., directs reactant gases to discrete regions of the substrate). (Col. 4, lines 13-16 and 60-65). And Mahawili provides great detail regarding how gas injection assembly 34 works (e.g., Mahawili describes the gas injection segments, channels, and orifices that work together to provide a specific gas flow profile during processing). However, the Mahawili reference does not ever disclose or suggest that gas flow through the gas injection assembly 34 occurs in any way that would *selectively control the temperature* of at least one of the localized regions of a semiconductor wafer *to minimize temperature deviation of the at least one localized region from a predetermined temperature*.

The gas injection assembly 34 of Mahawili is adapted to produce "uniform deposition on the substrate." (Col. 3, lines 53-58). For example, in some embodiments of Mahawili, the gas injection system is broken up into gas injection segments 36, 38, and 40, which introduce one or more gases to a discrete area of substrate 12 through channels (e.g., channels 36a-d), each of which includes orifices 42. These orifices 42 may be arranged to provide the same flow rate of gas across the width of substrate 12 or may be arranged in a non-uniform pattern to vary the profile of the gas flow across the substrate. Also, the number of orifices 42 and the spacing between those orifices

may be adjusted to provide "a more uniform flow or to direct more gas to one area of the substrate than another." (Col. 6, line 13 – col. 7, line 4).

Again, however, not a single portion of Mahawili's gas injection assembly 34 provides a gas *to selectively control the temperature* of at least one of the localized regions of a semiconductor wafer *to minimize temperature deviation of the at least one localized region from a predetermined temperature.*

The Figures of Mahawili even highlight the differences between Appellant's claimed methods and Mahawili's disclosure. Specifically, Mahawili's heater assembly 14, shown in Figures 2, 3, and 6, is located towards the bottom of reactor 10 and does not contain any sort of mechanism for "providing a gas." As best seen in Figure 2, heater assembly 14 is enclosed in a heater housing 16 and merely includes an array of heating elements such as linear tungsten-halogen lamps (not shown).

Additionally, gas injection assembly 34, shown in Figures 1 and 3-6, is located towards the top of reactor 10 and does not contain any sort of mechanism for "selectively controlling the temperature" of any localized region of the semiconductor substrate. As best seen in Figure 5, pieces of the gas injection assembly 34 (like orifices 42) can be manipulated *physically* to vary the gas *flow*, but Mahawili provides no indication that any part of gas injection assembly 34 can somehow selectively control the *temperature* of at least one localized region of a semiconductor wafer to minimize temperature deviation of the at least one localized region from a predetermined temperature.

An embodiment described in Appellant's specification at page 15 and in Figures 1-2 assists in illustrating the claim language "providing a gas to selectively control the

temperature" of at least one of the localized regions of a semiconductor wafer to minimize temperature deviation of the at least one localized region from a predetermined temperature. By way of example only, page 15 of the instant application describes the system 10 shown in Figure 1 as including a device 60 for locally cooling and/or heating certain regions of the semiconductor wafer 14. Here, in this embodiment, device 60 includes gas outlets 62 which supply cold gas or hot gas to the semiconductor wafer 14 to aid in selectively controlling the temperature of at least one localized region of the wafer to minimize temperature deviation of that region from a predetermined temperature. Again, though, no such "providing a gas" to "selectively control the temperature" of certain region(s) of a semiconductor wafer to minimize temperature deviation of those region(s) from a predetermined temperature is disclosed or in any way suggested by Mahawili.

Appellant respectfully submits, then, that independent claims 1, 48, and 50 are not anticipated by Mahawili at least for the reason that Mahawili does not disclose or in any way suggest the step—found in all of Appellant's pending claims—of providing of a gas to selectively control the temperature of at least one of the localized regions of a semiconductor wafer to minimize temperature deviation of the at least one localized region from a predetermined temperature.

II. Claims 46 and 49 Are Patentable Under 35 U.S.C. § 103(a) Over U.S. Patent No. 5,814,365 to Mahawili in view of U.S. Patent No. 5,874,711 to Champetier, et al.

Independent claims 46 and 49 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Mahawili in view of U.S. Patent No. 5,874,711 to Champetier, et al. With regard to claims 46 and 49, the Final Office Action stated that Mahawili

"substantially teach[es] the claimed method, as stated above," but does not "teach that the gas is supplied by a reflective device located below the semiconductor wafer." (Final Office Action, at 5).

First of all, as set forth in detail in Section 7.I. above, Appellant has respectfully shown that Mahawili does not teach or in any way suggest the step in independent claims 46 and 49 that requires the providing of a gas to selectively control the temperature of at least one of the localized regions of a semiconductor wafer to minimize temperature deviation of the at least one localized region from a predetermined temperature. And Champetier, et al. does not remedy this deficiency in the disclosure of Mahawili. Champetier, et al. is generally directed to a system and process for accurately determining the temperature of an object, such as a semiconductor wafer, by sampling from the object radiation being emitted at a particular wavelength.

While Champetier, et al. describes a reflective device (see, e.g., columns 7-8 and Figures 2-3), Champetier, et al. does not disclose or suggest the step (missing from Mahawili) of providing a gas to selectively control the temperature of at least one of a plurality of localized regions of a semiconductor wafer to minimize temperature deviation of the at least one localized region from a predetermined temperature. As shown in Fig. 1 of Champetier, et al., for instance, a processing chamber 12 is provided that includes a gas inlet 18 and a gas outlet 20 for introducing a gas into the chamber and/or for maintaining the chamber within a preset pressure range. (Col. 6, lines 45-51). Yet, Appellant notes that gas inlet 18 and gas outlet 20 do not provide selective control over the temperature of a *localized* region of wafer 14. Instead, gas inlet 18 and gas

outlet 20 provide a gas to the entire chamber 12, and not selectively to any particular region of the semiconductor wafer.

In short, then, Appellant respectfully submits that independent claims 46 and 49 patentably define over Mahawili and Champetier, et al., alone or in any proper combination.

8. Conclusion

Claims 1, 2, 5, 8-13, 44-45, 48, 50-51, 53, 56-60, and 62-64 have been rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,814,365 to Mahawili. However, Mahawili fails to teach each and every element of these claims. Additionally, claims 4, 6-7, 42, 46-47, 49, 52, 54-55, and 61 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Mahawili in view of U.S. Patent No. 5,874,711 to Champetier, et al. However, the combination of the Mahawili and Champetier, et al. references proposed in the Final Office Action still fails to teach or suggest certain limitations of Appellant's claims. As such, a *prima facie* showing of unpatentability has not been made, and Appellant is entitled to the issuance of a patent.

Respectfully submitted,

DORITY & MANNING, P.A.

Jason W. Johnston
Registration No. 45,675

DORITY & MANNING, P.A.
P.O. Box 1449
Greenville, SC 29602-1449
Phone: (864) 271-1592
Facsimile: (864) 233-7342

Date: 8/9/05

CLAIMS APPENDIX

Claims Involved in the Appeal:

1. A method for heat treating a semiconductor wafer, said method comprising the steps of:

placing a semiconductor wafer in a thermal processing chamber that is in communication with a plurality of lamps, said semiconductor wafer defining a plurality of localized regions along a radial axis;

adjusting the temperature of said semiconductor wafer to a predetermined temperature according to a predetermined heat cycle, said predetermined heat cycle including a heating stage in which said semiconductor wafer is heated by said plurality of lamps;

during at least one stage of said predetermined heat cycle, providing a gas to selectively control the temperature of at least one of said localized regions of said semiconductor wafer to minimize temperature deviation of said at least one localized region from said predetermined temperature.

2. A method as defined in claim 1, further comprising the steps of:

monitoring the temperature of said at least one localized region with a temperature sensing device, said temperature sensing device being in communication with a controller; and

based on information received by said controller from said temperature sensing device, controlling the temperature of said at least one localized region according to said predetermined heat cycle.

4. A method as defined in claim 1, further comprising the step of controlling the temperature of said gas.

5. A method as defined in claim 1, further comprising the step of controlling the flow rate of said gas.

6. A method as defined in claim 1, wherein said temperature deviation is less than about 100°C.

7. A method as defined in claim 1, wherein said temperature deviation is less than about 25°C.

8. A method as defined in claim 1, wherein said at least one localized region comprises less than about 50% of a cross-section of said semiconductor wafer.

9. A method as defined in claim 1, wherein said at least one localized region comprises less than about 25% of a cross-section of said semiconductor wafer.

10. A method as defined in claim 1, wherein said at least one localized region comprises less than about 15% of a cross-section of said semiconductor wafer.

11. A method as defined in claim 1, wherein said temperature of said at least one localized region is decreased during said heating stage of said predetermined heat cycle.

12. A method as defined in claim 1, wherein said predetermined heat cycle further comprises a cooling stage.

13. A method as defined in claim 12, wherein said temperature of said at least one localized region is increased during said cooling stage of said predetermined heat cycle.

42. A method as defined in claim 1, wherein said gas used to selectively control the temperature of at least one of said localized regions is supplied by a device located below said semiconductor wafer.

44. A method as defined in claim 1, wherein said gas used to selectively control the temperature of at least one of said localized regions is supplied by a device located above said semiconductor wafer.

45. A method as defined in claim 44, wherein said device comprises a gas pipe having a plurality of gas outlets.

46. A method for heat treating a semiconductor wafer, said method comprising the steps of:

placing a semiconductor wafer in a thermal processing chamber, said semiconductor wafer defining a plurality of localized regions along a radial axis;

adjusting the temperature of said semiconductor wafer using a plurality of lamps to a predetermined temperature according to a predetermined heat cycle, said predetermined heat cycle including a heat stage;

during at least one stage of predetermined heat cycle, providing a gas to selectively control the temperature of at least one of said localized regions of said semiconductor wafer to minimize temperature deviation of said at least one localized region from said predetermined temperature, said gas being supplied by a reflective device located below said semiconductor wafer.

47. A method as defined in claim 46, wherein a plurality of gas outlets extend through said reflective device.

48. A method for heat treating a semiconductor wafer, said method comprising the steps of:

placing a semiconductor wafer in a thermal processing chamber, said semiconductor wafer defining a plurality of localized regions along a radial axis;

adjusting the temperature of said semiconductor wafer using a plurality of lamps to a predetermined temperature according to a predetermined heat cycle, said predetermined heat cycle including a heat stage;

during at least one stage of predetermined heat cycle, providing a gas to selectively control the temperature of at least one of said localized regions of said semiconductor wafer to minimize temperature deviation of said at least one localized region from said predetermined temperature, said gas being supplied by a gas pipe located above said semiconductor wafer, wherein said gas pipe has a plurality of gas outlets.

49. A method for heat treating a semiconductor wafer, said method comprising the steps of:

placing a semiconductor wafer in a thermal processing chamber that is in communication with a plurality of lamps, said semiconductor wafer defining a plurality of localized regions along a radial axis;

adjusting the temperature of said semiconductor wafer to a predetermined temperature according to a predetermined heat cycle, said predetermined heat cycle including a heating stage in which said semiconductor wafer is heated by said plurality of lamps;

during at least one stage of said predetermined heat cycle, providing a gas to selectively control the temperature of at least one of said localized regions of said semiconductor wafer to minimize temperature deviation of said at least one localized region from said predetermined temperature, wherein said gas used to selectively control the temperature of at least one of said localized regions is supplied by a device located below said semiconductor wafer, wherein said device is a reflective device through which a plurality of gas outlets extend.

50. A method for heat treating a semiconductor wafer, said method comprising the steps of:

placing a semiconductor wafer in a thermal processing chamber that is in communication with a plurality of lamps, said semiconductor wafer defining a plurality of localized regions along a radial axis;

adjusting the temperature of said semiconductor wafer to a predetermined temperature according to a predetermined heat cycle, said predetermined heat cycle including a heating stage in which said semiconductor wafer is heated by said plurality of lamps and a cooling stage;

during said cooling stage, providing a gas to selectively control the temperature of at least one of said localized regions of said semiconductor wafer to minimize temperature deviation of said at least one localized region from said predetermined temperature.

51. A method as defined in claim 50, further comprising the steps of:

monitoring the temperature of said at least one localized region with a temperature sensing device, said temperature sensing device being in communication with a controller; and

based on information received by said controller from said temperature sensing device, controlling the temperature of said at least one localized region according to said predetermined heat cycle.

52. A method as defined in claim 50, further comprising the step of controlling the temperature of said gas.

53. A method as defined in claim 50, further comprising the step of controlling the flow rate of said gas.

54. A method as defined in claim 50, wherein said temperature deviation is less than about 100°C.

55. A method as defined in claim 50, wherein said temperature deviation is less than about 25°C.

56. A method as defined in claim 50, wherein said at least one localized region comprises less than about 50% of a cross-section of said semiconductor wafer.

57. A method as defined in claim 50, wherein said at least one localized region comprises less than about 25% of a cross-section of said semiconductor wafer.

58. A method as defined in claim 50, wherein said at least one localized region comprises less than about 15% of a cross-section of said semiconductor wafer.

59. A method as defined in claim 58, wherein said temperature of said at least one localized region is increased during said cooling stage.

60. A method as defined in claim 58, wherein said temperature of said at least one localized region is decreased during said cooling stage.

61. A method as defined in claim 50, wherein said gas used to selectively control the temperature of at least one of said localized regions is supplied by a device located below said semiconductor wafer.

62. A method as defined in claim 50, wherein said gas used to selectively control the temperature of at least one of said localized regions is supplied by a device located above said semiconductor wafer.

63. A method as defined in claim 62, wherein said device comprises a gas pipe having a plurality of gas outlets.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.